

What is claimed is:

1. In a fermentation process, the process including the steps of placing a fermentation medium in a vessel, maintaining the fermentation medium in the vessel for a sufficient time to enable a fermentation process to occur in the vessel, and withdrawing a product from the vessel,

the improvement wherein a stream of substantially pure oxygen is injected into the vessel while the fermentation process is occurring, and wherein the stream of substantially pure oxygen comprises the sole reactive gas, from any source external to the vessel, that is injected into the vessel.

2. The improvement of Claim 1, wherein the stream of substantially pure oxygen is moved through the vessel solely due to pressure in an oxygen supply.

3. The improvement of Claim 1, wherein the process further comprises mechanically agitating the fermentation medium, measuring a concentration of oxygen in an exhaust line extending from the vessel, and adjusting a flow of oxygen into the vessel in response to a measured concentration of oxygen.

4. The improvement of Claim 3, wherein the measuring and adjusting steps are performed substantially continuously.

5. The improvement of Claim 1, wherein the process is performed without mechanical agitation of contents of the vessel, and wherein the process includes measuring a concentration of oxygen in a head space in the vessel, recycling gas from the head space into the vessel if the concentration of oxygen is greater than a predetermined level, and venting gas from the head space to a region outside the vessel if the concentration of oxygen is less than a predetermined level.

6. The improvement of Claim 5, wherein the measuring step is performed substantially continuously.

7. In a fermentation process, the process including the steps of placing a fermentation medium in a vessel, maintaining the fermentation medium in the vessel for a sufficient time to enable a fermentation process to occur in the vessel, and withdrawing a product from the vessel,

the improvement wherein a stream of substantially pure oxygen is injected into the vessel while the fermentation process is occurring, and wherein the stream of substantially pure oxygen comprises the sole gas, from any source external to the vessel, that is injected into the vessel.

8. In an air-lifted fermentation process, the process including the steps of placing a fermentation medium in a vessel, maintaining the fermentation medium in the vessel for a sufficient time to enable a fermentation process to occur in the vessel, and withdrawing a product from the vessel,

the improvement wherein a stream of substantially pure oxygen is injected into the vessel while the fermentation process is occurring, and wherein pressure of the stream of substantially pure oxygen comprises the sole means for moving said oxygen through the vessel.

9. The improvement of Claim 8, wherein the process is performed without mechanical agitation of contents of the vessel, and wherein the process includes measuring a concentration of oxygen in a head space in the vessel, recycling gas from the head space into the vessel if the concentration of oxygen is greater than a predetermined level, and venting gas from the head space to a region outside the vessel if the concentration of oxygen is less than a predetermined level.

10. The improvement of Claim 9, wherein the process also includes measuring a pH of the fermentation medium, and directing a relatively inert

gas into the vessel so as to drive carbon dioxide out of the medium, when the pH in the medium has reached a predetermined point.

11. A mechanically-agitated fermenter, comprising:

- a) a vessel capable of holding a fermentation medium,
- b) a mechanical agitator disposed within the vessel,
- c) a diffuser located within the vessel,

d) a supply of substantially pure oxygen, the oxygen supply being in fluid communication with the diffuser, the oxygen supply being the only source of gas, external to the vessel, that is connected to the diffuser, and

e) an analyzer for measuring a concentration of oxygen in an exhaust line extending from the vessel, the analyzer being connected to an adjustable valve for controlling a flow of oxygen from the supply to the diffuser.

12. The fermenter of Claim 11, wherein the diffuser comprises a ring formed of a hollow pipe, the pipe having perforations, and a plurality of members extending from the ring, the members also having perforations, wherein the members and the pipe are both in fluid communication with the oxygen supply.

13. The fermenter of Claim 12, wherein the agitator includes an impeller, and wherein the members extend to a vicinity of the impeller.

14. The fermenter of Claim 13, wherein the vessel has a bottom, and wherein the members are located in a vicinity of the bottom of the vessel.

15. An air-lifted fermenter, comprising:

- a) a vessel capable of holding a fermentation medium,
- b) a diffuser located within the vessel,
- c) a supply of substantially pure oxygen, the oxygen supply being in

fluid communication with the diffuser, and

d) an analyzer for measuring a concentration of oxygen in a head space within the vessel, the analyzer being connected to an adjustable valve for controlling a flow of gas from the head space back to the vessel, the analyzer also being connected to an exhaust valve for venting gas from the head space.

16. The fermenter of Claim 15, further comprising an eductor, positioned to receive oxygen from the supply and to receive gas flowing out of the head space and through said adjustable valve.

17. The fermenter of Claim 15, wherein the diffuser comprises a ring formed of a hollow pipe, the pipe having perforations, and a plurality of members extending from the ring, the members also having perforations, wherein the members and the pipe are both in fluid communication with the oxygen supply.

18. The fermenter of Claim 17, wherein the members extend along a substantial portion of a vertical extent of the vessel.

19. The fermenter of Claim 15, further comprising a pH control unit for measuring pH of the fermentation medium and for causing a relatively inert gas to be injected into the vessel when the pH of the medium reaches a predetermined point.

20. A fermentation process comprising directing substantially pure oxygen into a vessel containing a fermentation medium, so as to promote fermentation in said medium, wherein said substantially pure oxygen is the only reactive gas, external to the vessel, that is injected into the vessel.

21. The process of Claim 20, wherein oxygen is moved through the vessel solely due to pressure of oxygen.

22. A fermentation process comprising directing substantially pure

oxygen into a vessel containing a fermentation medium, so as to promote fermentation in said medium, wherein pressure of said substantially pure oxygen is the sole means for moving oxygen through the vessel.

23. A fermenter comprising a vessel, and a supply of substantially pure oxygen, the oxygen supply being in fluid communication with said vessel, wherein the oxygen supply is the only source of reactive gas, external to the vessel, that is in fluid communication with the vessel.

24. A fermenter comprising a vessel, and a supply of substantially pure oxygen, the oxygen supply being in fluid communication with said vessel, wherein pressure of the oxygen supply is the sole means for moving oxygen through the vessel.